JAPANESE [JP,2003-113391,A]

CLAIMS DETAILED DESCRIPTION TECHNICAL FIELD PRIOR ART EFFECT OF THE INVENTION TECHNICAL PROBLEM MEANS EXAMPLE

[Translation done.]

* NOTICES *

JPO and INPIT are not responsible for any damages caused by the use of this translation.

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention]This invention relates to the suitable lubricating oil composition for the lubricating oil composition which has the outstanding shudder prevention performance, maintains shudder prevention performance for a long period of time, and has a long fatigue life especially an automatic transmission, and/or a nonstep variable speed gear in detail about a lubricating oil composition.
[0002]
[Description of the Prior Art]The friction characteristics, such as thermal oxidation stability, abrasion resistance, and a wet clutch, etc. are demanded of the automatic transmission from the former.
In order to raise such performance, the lubricating oil which contains various additive agents, such as an antioxidant, a detergent additive, an antiwear agent, a friction modifier, a seal swelling agent, a viscosity index improver, a defoaming agent, and colorant, is suitably used for base oil.

[0003]The latest automatic transmission is expected the lightweight miniaturization and improvement in transmitting power capability is pursued with the high increase in power of the engine put further together. Therefore, the performance which prevents the pitching (defect of the lubricous side by damage etc.) in the surfaces, such as a bearing

and a gear, etc. where high lubrication performance is maintained, and lengthens a fatigue life is required of the lubricating oil used for these. Control (slip lock-up control) which lets the lock-up clutch built in the torque converter in many automatic transmissions slide at a low speed is performed in recent years. An engine torque can be efficiently transmitted to a gearbox style, absorbing an engine torque variation and raising a degree of comfort by this. What is called slide control that performs start from a halt condition smoothly by combining with them after letting a wet starting clutch slide in some nonstep variable speed gears in the beginning is performed. The outstanding shudder prevention performance to slide control of these lock-up clutches and starting clutches and the performance which maintains this shudder prevention performance for a long period of time are demanded.

[0004]In order to lengthen a fatigue life among these military requirements, it is known from the former that it is effective to add the sulfur-systems additive agent which gives the outstanding extreme pressure property and wear tightness. However, since its activity over a surface of metal is strong while a sulfur-systems additive agent is excellent in an extreme pressure property, wear by corrosive wear is not avoided but there is a problem in using it alone. In order to maintain shudder prevention performance and its shudder prevention performance for a long period of time, it is necessary to add a proper quantity of friction modifiers which maintain the friction characteristic of a lock-up clutch good. however, if the effect which lengthens the above fatigue lives uses together such a friction modifier and said sulfur-systems additive agent small to a friction modifier, when the oxidation stability of a lubricating oil gets worse, the effect of maintaining the shudder prevention performance of a friction modifier will fall at an early stage. That is, it suited the very difficult situation that it is compatible in pitching prevention performance, and shudder prevention and maintenance performance in conventional technology.

[0005]

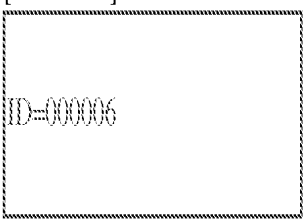
[Problem(s) to be Solved by the Invention]In view of the above situations, the technical problem of this invention is long, unites it, and the fatigue life by the prevention from pitching of a gearbox Sufficient shudder prevention performance, It is providing the lubricating oil composition having the performance which maintains shudder prevention performance for a long period of time especially an automatic transmission, and/or the suitable lubricating oil composition for nonstep variable speed gears.

[0006]

[Means for Solving the Problem]As for this invention, (B) total basicity calcium salicylate of 50 - 300 mgKOH/g as an amount of calcium elements on a constituent whole-quantity standard to (A) lubricant base oil 0.005 - 0.07 mass %, SP system extreme pressure agent as an amount of phosphorus elements on a constituent whole-quantity standard (C) 0.005 to 0.07 mass %, One sort or two sorts or more of compounds chosen from a group which consists of a succinimid compound expressed with the following general formula (3) and (4) on a constituent whole-quantity standard (D) 0.1 - 6 mass %, (E) Contain 0.001 - 0.05 mass % for a boron containing ashless dispersing agent as an amount of boron elements on a constituent whole-quantity standard, and provide a lubricating oil composition characterized by things.

[0007]

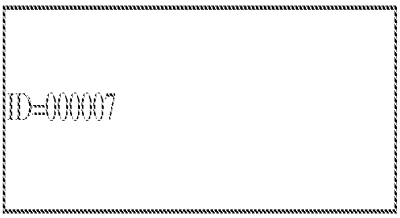
[Formula 5]



[0008](In a general formula (3), R^{11} expresses the hydrocarbon group of the straight chain shape of the carbon numbers 8-30, or the letter of branching, R^{12} expresses the hydrocarbon group of a hydrogen atom or the carbon numbers 1-30, R^{13} expresses the hydrocarbon group of the carbon numbers 1-4, and m expresses the integer of 1-7.)

[0009]

[Formula 6]



[0010](In a general formula (4), R^{14} and R^{15} express the hydrocarbon group of the straight chain shape of the carbon numbers 8-30, or the letter of branching individually, respectively, R^{16} and R^{17} express the hydrocarbon group of the carbon numbers 1-4 individually, respectively, and n expresses the integer of 1-7.)

[0011]

[Embodiment of the Invention]As lubricant base oil (A) in the lubricating oil composition of this invention, arbitrary mineral oil and/or synthetic oil which are used can be used as base oil of the usual lubricating oil. As mineral oil, a crude oil specifically atmospheric distillation and the lubricating oil fraction produced by carrying out distillation under reduced pressure, Purification treatment, such as solvent deasphalting, solvent extraction, hydrocracking, solvent dewaxing, contact dewaxing, hydrorefining, sulfuric acid treatment, and clay treatment, etc. can be mentioned for oils, normal paraffin, etc., such as one or paraffin series which was combined suitably and refined two or more, and a naphthene system. as synthetic oil -- for example, the Polly alpha olefin (1-octene oligomer.) The hydrides, such as 1-decene oligomer and an ethylene-propylene oligomer, Isobutene oligomer or its hydride, isoparaffin, alkylbenzene, alkyl naphthalene and diester (a ditridecyl GURUTA rate and a JI 2-ethylhexyl horse mackerel peat.) Di-isodecyl adipate, a ditridecyl horse mackerel peat, JI 2-ethylhexyl sebacate, etc., a polyol ester (a trimethylolpropane KAPURI rate and trimethylolpropane pelargonate.) Pentaerythritol 2-ethylhexanoate, pentaerythritol pelargonate, etc. can mention polyoxy alkylene glycol, dialkyl diphenyl ether, a polyphenyl ether, etc.

[0012]In order to raise much more fatigue life in this invention, the kinetic viscosity of 100 (A-1) ** Mineral oil of 2-6-mm^2/s, synthetic oil, or those mixtures, (A-2) It is preferred that the kinetic viscosity of 100 ** mixes and uses 10-50mm^2/s and two sorts of base oil in which kinetic viscosity with heavy mineral oil of 15-45-mm^2/s differs preferably. However, it is desirable still more preferred that it is 1-10mm^2/s, and the kinetic viscosity of 100 ** of the base oil produced by mixing such base oil in this invention is 2-8mm^2/s. It is desirable still more preferred that it is 60 to 99.5:40-0.5 in the mass ratio of : (A-1) (A-2), and the mixture ratio of the base oil of the kinetic viscosity of the above (A-1) and the base oil of the kinetic viscosity of (A-2) is 65-95:35-5. When the further improved effect of the fatigue life according [the addition of the base oil of the kinetic viscosity of (A-2)] to mixing of heavy base oil in less than 0.5 mass % is not acquired and the addition exceeds 40 mass %, the cold-temperature fluidity of a lubricating oil gets worse, and it may have an adverse effect on the low-temperature-starting nature of a gearbox.

[0013]As calcium salicylate which is the (B) ingredient of this invention, For example, neutral calcium salicylate, basic calcium salicylate, carbonate persalt group nature (ultrabasic properties) calcium salicylate, borate salt persalt group nature (ultrabasic properties) calcium salicylate, these mixtures, etc. are mentioned. The process in particular of calcium

salicylate is not limited. For example, said neutral (normal salt) calcium salicylate, the carbon numbers 10-30 -- it can manufacture preferably by 12-20, the method of making one piece or the alkyl salicylic acid which it has two pieces the alkyl group of 14-18 react to calcium salt groups (an oxide, hydroxide, etc. of calcium) under existence of a sulfur element or absence still more preferably, etc. As an alkyl group of said alkyl salicylic acid, For example, a decyl group, an undecyl group, the dodecyl, a tridecyl group, a tetradecyl group, A pentadecyl group, a hexadecyl group, a heptadecyl group, an octadecyl group, A nonadecyl group, an icosyl group, a henicosyl group, a docosyl group, a tricosyl group, a tetracosyl group, a pentacosyl group, a hexacosyl group, a heptacocyl group, an octacosyl group, a nonacosyl group, a triacontyl group, etc. are mentioned. A tetradecyl group, a pentadecyl group, a hexadecyl group, a heptadecyl group, and an octadecyl group are especially preferred. Said basic calcium salicylate can be manufactured by the method of heating the salt and base of as superfluous calcium as said neutral (normal salt) calcium salicylate under existence of water etc. Said carbonate persalt group nature (ultrabasic properties) calcium salicylate can be manufactured under existence of carbon dioxide by the method of making said neutral (normal salt) calcium salicylate reacting to the base of calcium etc. Said borate salt persalt group nature (ultrabasic properties) salicylate, The method of making said neutral (normal salt) calcium salicylate react to boric acid compounds, such as a base of calcium and boric acid, or anhydrous boric acid, or said carbonate persalt group nature (ultrabasic properties) calcium salicylate, It can manufacture by the method etc. to which boric acid compounds, such as boric acid or anhydrous boric acid, are made to react.

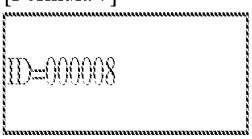
[0014](B) the basicity of an ingredient -- the total basicity -- basic calcium salicylate of 70 - 250 mgKOH/g is preferably desirable 50 to 300 mgKOH/g. The total basicity said here means the total basicity by the perchloric acid method measured based on 7. of JIS K2501 "the petroleum-products and lubricating oil-neutralization number examining method." The effect which controls the strength reduction to the cyclic compression of a wet clutch when the total basicity is less than 50 mgKOH/g is insufficient, and since the storage stability of a constituent gets worse on the other hand when the total basicity exceeds 300 mgKOH/g, it is not desirable respectively.

[0015]in this invention -- the content of the (B) ingredient -- a constituent whole-quantity standard -- the lower limit -- 0.005 mass % -- it is 0.01 mass % preferably -- on the other hand -- the upper limit -- 0.07 mass % -- it is 0.06 mass % preferably. (B) When the content of an ingredient is less than amount [of 0.005] %, a friction regulating function is insufficient and shudder prevention and a maintenance life become brief. On the other hand, when the content exceeds 0.07 mass %, there is a possibility that the calcium salt produced when calcium salicylate of the (B) ingredient decomposes may block the hole portion of a wet friction clutch, and may change a coefficient of friction.

[0016]The (C) ingredient in the lubricating oil composition of this invention is SP system extreme pressure agent, and, specifically, can mention the phosphorus compounds expressed with a following general formula (1), the phosphorus compounds expressed with a general formula (2), and those salts.

[0017]

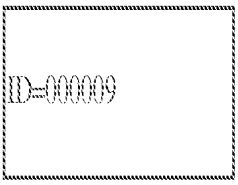
[Formula 7]



[0018]In a general formula (1), as for X^1, X^2, and X^3, at least one piece shows an oxygen atom with a sulfur atom, as for others. R^1, R^2, and R^3 show the hydrocarbon group of a hydrogen atom or the carbon numbers 1-30 individually, respectively.

[0019]

[Formula 8]



[0020]In a general formula (2), X^4, X^5, and X^6 show an oxygen atom or a sulfur atom individually, respectively. R^4, R^5, and R^6 show the hydrocarbon group of a hydrogen atom or the carbon numbers 1-30 individually, respectively.
[0021]Specifically as a hydrocarbon group of the carbon numbers 1-30 expressed with the above-mentioned R^1 - R^6, an alkyl group, a cycloalkyl group, an alkenyl group, an alkylation cycloalkyl group, an aryl group, an alkylation aryl group, and an arylated alkyl group can be mentioned. As the above-mentioned alkyl group, for example A methyl group, an ethyl group, a propyl group, A butyl group, a pentyl group, a hexyl group, a heptyl group, an octyl group, a nonyl group, Alkyl groups (straight chain shape or a letter of branching may be sufficient as these alkyl groups), such as a decyl group, an undecyl group, dodecyl, a tridecyl group, a tetradecyl group, a pentadecyl group, a hexadecyl group, a heptadecyl group, and an octadecyl group, can be mentioned. As the above-mentioned cycloalkyl group, a cycloalkyl group of the carbon numbers 5-7 of a cyclopentylic group, a cyclohexyl group, a cycloheptyl group, etc. can be mentioned, for example. As the above-mentioned alkyl cycloalkyl group, For example, a methyl cyclopentylic group, a dimethyl cyclopentylic group, a methylethyl cyclopentylic group, A diethyl cyclopentylic group, a methylcyclohexyl group, a dimethyl cyclohexyl group, A methylethyl cyclohexyl group, a diethyl cyclohexyl group, a methyl cycloheptyl group, An alkyl cycloalkyl group (replacement positions to a cycloalkyl group of an alkyl group are also arbitrary) of the carbon numbers 6-11 of a dimethyl cycloheptyl group, a methylethyl cycloheptyl group, a diethyl cycloheptyl group, etc. can be mentioned.
[0022]As the above-mentioned alkenyl group, for example A butenyl group, a pentenyl group, a hexenyl group, A heptenyl group, an octenyl group, a nonenyl group, a decenyl group, an undecenyl group, Alkenyl groups (straight chain shape or a letter of branching may be sufficient as these alkenyl groups, and their position of a double bond is also arbitrary), such as a dodecenyl group, a tridecenyl group, a tetra decenyl group, a penta decenyl group, a hexa decenyl group, a heptadecenyl group, and an octadecenyl group, can be mentioned.
[0023]As the above-mentioned aryl group, aryl groups, such as a phenyl group and a naphthyl group, can be mentioned, for example. As the above-mentioned alkyl aryl group, for example A tolyl group, a xylyl group, An ethyl phenyl group, a propyl phenyl group, a buthylphenyl group, a pentyl phenyl group, A hexyl phenyl group, a heptyl phenyl group, an octyl phenyl group, a nonylphenyl group, An alkyl aryl group (straight chain shape or a letter of branching may be sufficient as an alkyl group, and its replacement positions to an aryl group are also arbitrary) of the carbon numbers 7-18, such as a decyl phenyl group, an undecyl phenyl group, and a dodecyl phenyl group, can be mentioned. As the above-mentioned arylated alkyl group, for example Benzyl, a phenylethyl group, An arylated alkyl group (straight chain shape or a letter of branching may be sufficient as these alkyl groups) of the carbon numbers 7-12, such as a phenylpropyl group, a phenylbutyl group, a phenylpentyl group, and a phenyl hexyl group, can be mentioned.
[0024]It is the alkyl groups of the carbon numbers 4-20 that they are an alkyl group of the carbon numbers 1-30 or an aryl group of the carbon numbers 6-24 desirable still more preferably, and a hydrocarbon group of the carbon numbers 1-30 expressed with the above-mentioned R^1 - R^6 is an alkyl group of the carbon numbers 6-18 still more preferably.
[0025]As an SP system extreme pressure agent expressed with a general formula (1), the following phosphorus compounds can be mentioned, for example.

Thiophosphorous acid; Monopropyl thio phosphite, monobutyl thio phosphite, Monopentylthio phosphite, monohexylthio phosphite, MONOPEPU chill thio phosphite, Thiophosphorous acid monoalkyl ester, such as monooctylthio phosphite and mono- laurylthio phosphite (straight chain shape or a letter of branching may be sufficient as an alkyl group); Monophenyl thio phosphite, Thiophosphorous acid mono(alkyl) (aryl) ester, such as mono- cresyl thio phosphite; Dipropylthio phosphite, Dibutylthio phosphite, dipentylthio phosphite, dihexylthio phosphite, Thiophosphorous acid dialkyl ester, such as JIPEPU chill thio phosphite, dioctylthio phosphite, and dilauryl thio phosphite (straight chain shape or a letter of branching may be sufficient as an alkyl group); Diphenylthio phosphite, Thiophosphorous acid JI (alkyl) (aryl) ester, such as JIKUREJIRU thio phosphite; TORIPURO pill thio phosphite, Tributylthio phosphite, tripentyl thio phosphite, trihexyl thio phosphite, TORIPEPU chill thio phosphite, trioctyl thio phosphite, Thio trialkyl phosphite ester, such as TORIRAURIRU thio phosphite (straight chain shape or a letter of branching may be sufficient as an alkyl group); thiophosphorous acid Tori (alkyl) (aryl) ester, such as triphenylthio phosphite and TORIKUREJIRU thio phosphite;

[0026]Dithiophosphorous acid; Monopropyl dithio phosphite, monobutyl dithio phosphite, Monopentyldithio phosphite, monohexyldithio phosphite, MONOPEPU chill dithio phosphite, monooctyldithio phosphite, Dithiophosphorous acid monoalkyl ester, such as mono- lauryl dithio phosphite (straight chain shape or a letter of branching may be sufficient as an alkyl group); Monophenyl dithio phosphite, Dithiophosphorous acid mono(alkyl) (aryl) ester, such as mono- cresyl dithio phosphite; Dipropyldithio phosphite, Dibutyldithio phosphite, dipentyldithio phosphite, dihexyldithio phosphite, Dithiophosphorous acid dialkyl ester, such as JIPEPU chill dithio phosphite, dioctyldithio phosphite, and dilauryl dithio phosphite (straight chain shape or a letter of branching may be sufficient as an alkyl group); Diphenyldithio phosphite, Dithiophosphorous acid JI (alkyl) (aryl) ester, such as JIKUREJIRU dithio phosphite; TORIPURO pill dithio phosphite, tributyldithio phosphite, tripentyl dithio phosphite, trihexyl dithio phosphite, TORIPEPU chill dithio phosphite, Dithio trialkyl phosphite ester, such as trioctyl dithio phosphite and TORIRAURIRU dithio phosphite (straight chain shape or a letter of branching may be sufficient as an alkyl group); Triphenyldithio phosphite, Dithiophosphorous acid Tori (alkyl) (aryl) ester, such as TORIKUREJIRU dithio phosphite;

TORICHIO phosphorous acid; Monopropyl TORICHIO phosphite, monobutyl TORICHIO phosphite, Monopentyl TORICHIO phosphite, monohexyl TORICHIO phosphite, Mono- PEPUCHIRUTORI thio phosphite, monooctyl TORICHIO phosphite, TORICHIO phosphorous acid monoalkyl ester, such as mono- lauryl TORICHIO phosphite (straight chain shape or a letter of branching may be sufficient as an alkyl group); TORICHIO phosphorous acid mono (alkyl) (aryl) ester, such as monophenyl TORICHIO phosphite and mono- cresyl TORICHIO phosphite;

[0027]dipropyl TORICHIO phosphite and a jib -- tilt RICHIO phosphite. Dipentyl TORICHIO phosphite, dihexyl TORICHIO phosphite, JIPEPUCHIRUTORICHIO phosphite, dioctyl TORICHIO phosphite, TORICHIO phosphorous acid dialkyl ester, such as dilauryl TORICHIO phosphite (straight chain shape or a letter of branching may be sufficient as an alkyl group); Diphenyl TORICHIO phosphite, TORICHIO phosphorous acid JI (alkyl) (aryl) ester, such as JIKUREJIRUTORI thio phosphite; TORIPUROPIRUTORI thio phosphite, Tributyl TORICHIO phosphite, tripentyl TORICHIO phosphite, Trihexyl TORICHIO phosphite, TORIPEPUCHIRUTORICHIO phosphite, TORICHIO trialkyl phosphite ester, such as trioctyl TORICHIO phosphite and trilauryl trithiophosphite (straight chain shape or a letter of branching may be sufficient as an alkyl group); Triphenyl TORICHIO phosphite, TORICHIO phosphorous acid Tori (alkyl) (aryl) ester; and these mixtures, such as TORIKUREJIRUTORI thio phosphite.

[0028]In this invention, it is preferred that two or more in X^1 of the above-mentioned general formula (1) - X^3 are a sulfur atom, and it is still more preferred that all three pieces are sulfur atoms.

[0029]As an SP system extreme pressure agent expressed with a general formula (2), the following phosphorus compounds can be mentioned, for example.
Thiophosphoric acid; Monopropyl thio phosphate, monobutyl thio phosphate, Monopentylthio phosphate, monohexylthio phosphate, MONOPEPU chill thio phosphate, Thiophosphoric acid monoalkyl ester, such as monooctylthio phosphate and mono- laurylthio phosphate (straight chain shape or a letter of branching may be sufficient as an alkyl group); Monophenyl thio phosphate, Thiophosphoric acid mono(alkyl) (aryl) ester, such as mono- cresyl thio phosphate; Dipropylthio phosphate, Dibutylthio phosphate, dipentylthio phosphate, dihexylthio phosphate, Thiophosphoric acid dialkyl ester, such as JIPEPU chill thio phosphate, dioctylthio phosphate, and dilauryl thio phosphate (straight chain shape or a letter of branching may be sufficient as an alkyl group); Diphenylthio phosphate, ********** (alkyl) (aryl) ester, such as JIKUREJIRU thio phosphate; TORIPURO pill thio phosphate, Tributylthio phosphate, tripentyl thio phosphate, trihexyl thio phosphate, TORIPEPU chill thio phosphate, trioctyl thio phosphate, Thiophosphoric acid trialkyl ester, such as TORIRAURIRU thio phosphate (straight chain shape or a letter of branching may be sufficient as an alkyl group); thiophosphoric acid Tori (alkyl) (aryl) ester, such as triphenylthio phosphate and TORIKUREJIRU thio phosphate;
[0030]Dithiophosphate; Monopropyl dithiophosphate, monobutyl dithiophosphate, Monopentyl dithiophosphate, monohexyl dithiophosphate, MONOPEPU chill dithiophosphate, monooctyl dithiophosphate, Dithiophosphate monoalkyl ester, such as mono- lauryl dithiophosphate (straight chain shape or a letter of branching may be sufficient as an alkyl group); Monophenyl dithiophosphate, Dithiophosphate mono(alkyl) (aryl) ester, such as mono- cresyl dithiophosphate; Dipropyl dithiophosphate, Dibutyl dithiophosphate, dipentyl dithiophosphate, dihexyl dithiophosphate, Dithiophosphate dialkyl ester, such as JIPEPU chill dithiophosphate, dioctyl dithiophosphate, and dilauryl dithiophosphate (straight chain shape or a letter of branching may be sufficient as an alkyl group); Diphenyl dithiophosphate, ********** (alkyl) (aryl) ester, such as JIKUREJIRU dithiophosphate; TORIPURO pill dithiophosphate, tributyl dithiophosphate, tripentyl dithiophosphate, trihexyl dithiophosphate, TORIPEPU chill dithiophosphate, Dithiophosphate trialkyl ester, such as trioctyl dithiophosphate and TORIRAURIRU dithiophosphate (straight chain shape or a letter of branching may be sufficient as an alkyl group); Triphenyl dithiophosphate, Dithiophosphate Tori (alkyl) (aryl) ester, such as TORIKUREJIRU dithiophosphate;
[0031]Tori thiophosphoric acid; Monopropyl TORICHIO phosphate, monobutyl TORICHIO phosphate, Monopentyl TORICHIO phosphate, monohexyl TORICHIO phosphate, Mono- PEPUCHIRUTORI thio phosphate, monooctyl TORICHIO phosphate, Tori thiophosphoric acid monoalkyl ester, such as mono- lauryl TORICHIO phosphate (straight chain shape or a letter of branching may be sufficient as an alkyl group); Monophenyl TORICHIO phosphate, Dithiophosphate mono(alkyl) (aryl) ester, such as mono- cresyl TORICHIO phosphate; Dipropyl TORICHIO phosphate, a jib -- tilt RICHIO phosphate and dipentyl TORICHIO phosphate. Dihexyl TORICHIO phosphate, JIPEPUCHIRUTORICHIO phosphate, Dithiophosphate dialkyl ester, such as dioctyl TORICHIO phosphate and dilauryl TORICHIO phosphate (straight chain shape or a letter of branching may be sufficient as an alkyl group); Diphenyl TORICHIO phosphate, Tori ********** (alkyl) (aryl) ester, such as JIKUREJIRUTORI thio phosphate; TORIPUROPIRUTORI thio phosphate, tributyl TORICHIO phosphate, tripentyl TORICHIO phosphate, trihexyl TORICHIO phosphate, TORIPEPUCHIRUTORICHIO phosphate, trioctyl TORICHIO phosphate, Tori thiophosphoric acid trialkyl ester, such as TORIRAURIRUTORI thio phosphate (straight chain shape or a letter of branching may be sufficient as an alkyl group); Tori thiophosphoric acid Tori (alkyl) (aryl) ester, such as triphenyl TORICHIO phosphate and TORIKUREJIRUTORI thio phosphate;

[0032]Tetra thiophosphoric acid; Monopropyl tetrathio phosphate, monobutyl tetrathio phosphate, Monopentyl TETORACHIO phosphate, monohexyl TETORACHIO phosphate, MONOPEPUCHIRU tetrathio phosphate, monooctyl TETORACHIO phosphate, Tetra thiophosphoric acid monoalkyl ester, such as mono- lauryl TETORACHIO phosphate (straight chain shape or a letter of branching may be sufficient as an alkyl group); Monophenyltetrathio phosphate, Dithiophosphate mono(alkyl) (aryl) ester, such as mono- cresyl TETORACHIO phosphate; Dipropyltetrathio phosphate, Dibutyltetrathio phosphate, dipentyltetrathio phosphate, Dihexyltetrathio phosphate, JIPEPUCHIRU tetrathio phosphate, Dithiophosphate dialkyl ester, such as dioctyltetrathio phosphate and dilauryl tetrathio phosphate (straight chain shape or a letter of branching may be sufficient as an alkyl group); Diphenyltetrathio phosphate, Tetra ********** (alkyl) (aryl) ester, such as JIKUREJIRU tetrathio phosphate; TORIPUROPIRU tetrathio phosphate, tributyltetrathio phosphate, Tripentyl tetrathio phosphate, trihexyl tetrathio phosphate, TORIPEPUCHIRU tetrathio phosphate, trioctyl tetrathio phosphate, Tetra thiophosphoric acid trialkyl ester, such as TORIRAURIRU tetrathio phosphate (straight chain shape or a letter of branching may be sufficient as an alkyl group); Triphenyltetrathio phosphate, Tetra thiophosphoric acid Tori (alkyl) (aryl) ester; and these mixtures, such as TORIKUREJIRU tetrathio phosphate.

[0033]In this invention, it is preferred that 1 thru/or 3 in X^4 of the above-mentioned general formula (2) - X^6 are sulfur atoms, and it is still more preferred that 1 or two pieces are sulfur atoms.

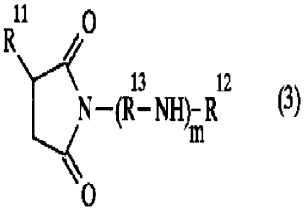
[0034]As a salt of phosphorus compounds expressed with the general formula (1) or (2), Nitrogen compounds, such as ammonia and an amine compound which has only a hydrocarbon group or a hydroxyl content hydrocarbon group of the carbon numbers 1-8 in a molecule, can be made to be able to act on phosphorus compounds, and a salt which neutralized a part or all of acid water matter that remains can be mentioned. As the above-mentioned nitrogen compound, specifically Ammonia; monomethylamine, Monoethyl amine, monopropyl amine, monobutyl amine, monopentylamine, Monohexylamine, monoheptyl amine, mono- octylamine, dimethylamine, Methylethyl amine, diethylamine, methylpropyl amine, ethyl propylamine, Dipropyl amine, methylbutyl amine, an ethyl butylamine, a propyl butylamine, Dibutyl amine, dipentylamine, dihexyl amine, diheptylamine, Alkylamine, such as dioctyl amine (straight chain shape or a letter of branching may be sufficient as an alkyl group); Monomethanol amine, Monoethanolamine, mono-propanolamine, monobutanol amine, Monopentanol amine, monohexanol amine, monoheptanol amine, Monooctanol amine, monononanol amine, dimethanol amine, Methanol ethanolamine, diethanolamine, methanol propanolamine, ethanol propanolamine, dipropanolamine, methanol butanol amine, ethanol butanol amine, propanol butanol amine, dibutanolamine, Alkanolamine [, such as dipentanol amine, dihexanol amine, diheptanol amine, and dioctanol amine,] (straight-chain-shape or letter of branching may be sufficient as alkanol group);, these mixtures, etc. can be illustrated.

[0035]These (C) ingredients can blend arbitrarily one kind or two kinds or more. When the (C) ingredient is used as a lubricating oil composition for gearboxes, it becomes possible [not only abrasion resistance but the optimized friction characteristic / in / further / a wet clutch] to give simultaneously. In a lubricating oil composition of this invention, content of the (C) ingredient is more than 0.005 mass % as phosphorus element concentration on a constituent whole-quantity standard, and it is 0.008 mass % preferably, and on the other hand, the content is below 0.07 mass %, and is below 0.06 mass % preferably. (C) Since it becomes easy to generate pitching when a case of less than 0.005 mass % is ineffective to abrasion resistance as a phosphorus element and content of an ingredient exceeds 0.07 mass %, it is not desirable respectively.

[0036]The (D) ingredient in a lubricating oil composition of this invention is a succinimid compound expressed with the following general formula (3) or (4).

[0037]

[Formula 9]

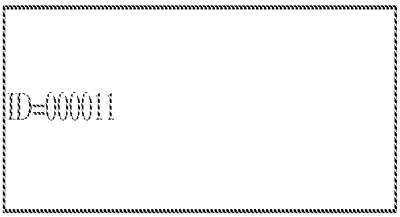


(3)

[0038]In a general formula (3), R^{11} expresses the hydrocarbon group of the straight chain shape of the carbon numbers 8-30, or the letter of branching. R^{12} expresses the hydrocarbon group of a hydrogen atom or the carbon numbers 1-30. R^{13} expresses the hydrocarbon group of the carbon numbers 1-4. m is an integer of 1-7.

[0039]

[Formula 10]



[0040]In a general formula (4), R^{14} and R^{15} express the hydrocarbon group of the straight chain shape of the carbon numbers 8-30, or the letter of branching individually, respectively. R^{16} and R^{17} express the hydrocarbon group of the carbon numbers 1-4 individually, respectively. n is an integer of 1-7.

[0041]in R^{11} of the above-mentioned general formula (3), R^{14} of a general formula (4), and R^{15} -- these -- respectively -- individual -- the carbon numbers 8-30 -- the straight chain shape or the letter hydrocarbon group of branching of the carbon numbers 12-25 is expressed preferably. As such a hydrocarbon group, although an alkyl group and an alkenyl group can be mentioned for example, it is preferred that it is an alkyl group. As an alkyl group, the straight chain shape or the letter alkyl group of branching to the carbon number 30 besides an octyl group, an octenyl group, a nonyl group, a nonenyl group, a decyl group, a decenyl group, the dodecyl, a dodecenyl group, an octadecyl group, and an octadecenyl group can be mentioned, for example. When the carbon number of a hydrocarbon group is less than 8, and when exceeding 30, sufficient shudder vibration isolation nature effect is hard to be acquired. In this invention, the alkyl group of the letter of branching of the carbon numbers 8-30 is more preferred, and it is preferred that it is especially a letter alkyl group of branching of the carbon numbers 10-25. When the letter alkyl group of branching of the carbon numbers 8-30 is used, compared with the case where a straight-chain-shape alkyl group is used, the lubricating oil composition in which higher torque capacity is shown can be obtained.

[0042]R^{13} of a general formula (3) and R^{16} of a general formula (4), and R^{17} express a hydrocarbon group of the carbon numbers 1-4 separately respectively. As a hydrocarbon group of 1-4, an alkylene group of 1-4 can be mentioned and, specifically, they are the carbon number 2 or an alkylene group (ethylene, propylene group) of 3 preferably.

[0043]R^{12} of a general formula (3) expresses straight chain shape or a letter hydrocarbon group of branching of a hydrogen atom or the carbon numbers 1-30. As straight chain shape of the carbon numbers 1-30 expressed with the above-mentioned R^{12}, or a letter hydrocarbon group of branching, an alkyl group or an alkenyl group of straight chain shape of the carbon numbers 1-30 or a letter of branching can be mentioned, for example. desirable -- the carbon numbers 1-30 -- more -- desirable -- the carbon numbers 8-30 -- it is an alkyl group or an alkenyl group of a letter of branching of

the carbon numbers 10-25 more preferably. It is preferred that it is especially an alkyl group of a letter of branching.

[0044]In a general formula (3) or (4), in order to obtain a lubricating oil composition in which n and m express an integer of 1-7, respectively, and higher torque capacity is shown, n and m are 1, 2, or 3 preferably, respectively, and are 1 especially preferably, respectively.

[0045]A succinimid compound expressed with the general formula (3) or (4) can be manufactured by a publicly known method. For example, it can obtain by the ability to make alkyl or an alkenyl succinic anhydride, and polyamine able to react. In monosuccinimid to which R^{12} is specifically expressed with a general formula (3) which is a hydrogen atom, For example, diethylenetriamine, triethylenetetramine, and 1 mol or more of polyamine like tetraethylenepentamine are received, 1 mol of succinic acid anhydrides with straight chain shape, a letter alkyl group of branching, or an alkenyl group of the carbon matter 8-30 under a nitrogen atmosphere, It can obtain by being gradually dropped at temperature of 140-175 ** preferably, making 130-180 ** react preferably for 2 to 6 hours for 1 to 10 hours, and carrying out distillation removal of the unreacted polyamine. It can obtain, when R^{12}, for example, makes N-octadecyl-1,3-propanediamine and the above-mentioned succinic acid anhydride react by the same method as the above in monosuccinimid expressed with a general formula (3) which is a hydrocarbon group of the carbon numbers 1-30. Also in screw succinimid furthermore expressed with a general formula (4), it can obtain by dropping 0.5 mol of the above polyamine on the same conditions as the above, making it react similarly, and removing moisture to generate to 1 mol of the above-mentioned succinic acid anhydrides.

[0046]Since a higher lubricating oil composition of torque transmission capacity can be obtained as a (D) ingredient in this invention compared with succinimid of a monotype expressed with a general formula (3), especially a thing for which screw type succinimid expressed with a general formula (4) is used is preferred.

[0047]In a lubricating oil composition of this invention, on a lubricating oil composition whole-quantity standard, content of the (D) ingredient is more than 0.1 mass %, and is more than 0.2 mass % preferably. On the other hand, on a lubricating oil composition whole-quantity standard, content of the (D) ingredient is below 6 mass %, and is below 4 mass % preferably. (D) when it is inferior to an effect of maintaining shudder prevention performance maintenance nature and good shift characteristics when content of an ingredient is less than 0.1 mass % and content of the (D) ingredient exceeds 6 mass % on the other hand, an effect of balancing an addition is not acquired.

[0048]The (E) ingredient in a lubricating oil composition of this invention is a boron containing ashless dispersing agent. It is important for the (E) ingredient of this invention to contain boron. (E) When non-ash powder medicine which does not contain boron is used as an ingredient, (B) Even if it uses together with an ingredient, the (C) ingredient, and the (D) ingredient, since performance which prevents fatigue of pitching, a flaking, etc. and prevents a shudder is inferior to abrasion resistance not only as it becoming impossible to demonstrate enough but a lubricating oil composition, or oxidation stability, the purpose of this invention cannot be attained.

[0049](E) As an ingredient, a denaturation thing by boron compounds, such as a nitrogen compound which has an alkyl group or an alkenyl group of the carbon numbers 40-400 in [at least one] a molecule, for example, or its derivative, is specifically mentioned, One kind arbitrarily chosen out of these or two kinds or more can be blended. Although straight chain shape or a letter of branching may be sufficient, as this alkyl group or an alkenyl group as a desirable thing, Specifically, a letter alkyl group of branching, a letter alkenyl group of branching, etc. which are derived from oligomer of olefins, such as propylene, 1-butene, and isobutylene, and co-oligomer of ethylene and propylene are mentioned. although a carbon number of this alkyl group or an alkenyl group is arbitrary -- desirable -- 40-400 -- it is 60-350 more preferably. Since there is a possibility that solubility over lubricant base oil of a compound may fall when a carbon

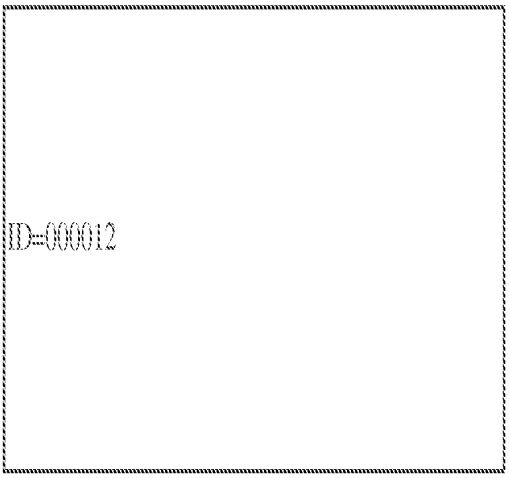
number of an alkyl group or an alkenyl group is less than 40, and there is a possibility that the cold-temperature fluidity of a lubricating oil composition may get worse, on the other hand when a carbon number of an alkyl group or an alkenyl group exceeds 400, it is not desirable respectively.

[0050]As an example of said nitrogen compound or its derivative, one sort or two sorts or more of compounds etc. which are chosen from the following are mentioned, for example.

(E-1) Succinimid which has an alkyl group or an alkenyl group of the carbon numbers 40-400 in [at least one] a molecule, Or benzylamine which has an alkyl group or an alkenyl group of the derivative (E-2) carbon numbers 40-400 in [at least one] a molecule, Or polyamine which has an alkyl group or an alkenyl group of the derivative (E-3) carbon numbers 40-400 in [at least one] a molecule or its derivative [0051](E-1) More specifically as succinimid, a compound etc. which are shown by the following general formula (5) and (6) are mentioned.

[0052]

[Formula 11]



[0053]in a general formula (5) -- R^{21} -- the carbon numbers 40-400 -- the alkyl group or alkenyl group of 60-350 is shown preferably -- a -- 1-5 -- the integer of 2-4 is shown preferably. in a general formula (6) -- R^{22} and R^{23} -- respectively -- individual -- the carbon numbers 40-400 -- the alkyl group or alkenyl group of 60-350 is shown preferably -- b -- 0-4 -- the integer of 1-3 is shown preferably.

[0054]Succinimid of a monotype expressed with the above-mentioned general formula (5) or screw type succinimid expressed with a general formula (6) is independent respectively, or can be mixed and used.

[0055](E-2) More specifically as benzylamine, a compound etc. which are expressed with a general formula (7) are mentioned.

[0056]

[Formula 12]

[0057]in a general formula (7) -- R^{24} -- the carbon numbers 40-400 -- the alkyl group or alkenyl group of 60-350 is shown preferably -- c -- 1-5 -- the integer of 2-4 is shown preferably. The benzylamine expressed with a general formula (7) about the manufacturing method. Although not limited at all, for example A propylene oligomer, polybutene, After making polyolefines, such as an ethylene-alpha olefin copolymer, react to phenol and considering it as alkylphenol, It can

obtain by making polyamine, such as formaldehyde, diethylenetriamine, triethylenetetramine, tetraethylenepentamine, and pentaethylenehexamine, react to this by a Mannich reaction.

[0058](E-3) More specifically as polyamine, a compound etc. which are expressed with a general formula (8) are mentioned.

R^{25}-NH-(CH_2CH_2 NH)$_d$-H (8)

in a general formula (8) -- R^{25} -- the carbon numbers 40-400 -- an alkyl group or an alkenyl group of 60-350 is shown preferably -- d -- 1-5 -- an integer of 2-4 is shown preferably. Although the manufacturing method is not limited at all, polyamine expressed with a general formula (8), For example, after chlorinating polyolefines, such as a propylene oligomer, polybutene, and an ethylene-alpha olefin copolymer, It can obtain by making polyamine, such as ammonia, ethylenediamine, diethylenetriamine, triethylenetetramine, tetraethylenepentamine, and pentaethylenehexamine, react to this.

[0059]As a derivative of a nitrogen compound expressed with above-mentioned (E-1) - (E-3), To the above nitrogen compounds, specifically Monocarboxylic acid (fatty acid etc.) and oxalic acid of the carbon numbers 2-30, Polycarboxylic acid of the carbon numbers 2-30 of phthalic acid, trimellitic acid, pyromellitic acid, etc. is made to act, A part or all of an amino group and/or an imino group which remain is neutralized, or what is called an amidated carboxylic acid denaturation compound, sulfur denaturation compounds which made a sulfur compound act on the above nitrogen compounds, these mixtures, etc. are mentioned.

[0060]The (E) ingredient of this invention denaturalizes above-mentioned nitrogen compounds or those derivatives with a boron compound. Although a modification method by nitrogen compound or a boron compound of those derivatives is not limited at all and arbitrary methods are possible for it, For example, boron compounds, such as boric acid, borate salt, or the ester of boric acid, are made to act on above-mentioned nitrogen compounds or those derivatives, and a method of neutralizing a part or all of an amino group and/or an imino group which remain in nitrogen compounds or those derivation inside of the body, or amidating is mentioned. Specifically as the above-mentioned boron compound, orthoboric acid, metaboric acid, tetraboric acid, etc. are mentioned. As borate salt, it is mentioned by alkali metal salt, alkaline earth metal salt, or ammonium salt of boric acid, etc., and specifically more specifically, Lithium borate, such as lithium metaborate, lithium tetraborate, 5 lithium borate, and lithium perboric acid; Sodium metaborate, 2 sodium borate, sodium tetraborate, 5 sodium borate, 6 sodium borate, Sodium borate, such as 8 sodium borate; Potassium metaboric acid, Potassium borate, such as potassium tetraborate, potassium pentabrate, 6 potassium borate, and 8 potassium borate; Calcium metaboric acid, 2 calcium borate, tricalcium tetraborate, tetraboric acid 5 calcium, Calcium borate, such as 6 calcium borate; Magnesium metaboric acid, Ammonium pentaborate, such as magnesium borate [, such as 2 magnesium borate, tetraboric acid 3 magnesium, tetraboric acid 5 magnesium and 6 magnesium borate]; and metaboric acid ammonium, tetraboric acid ammonium, 5 ammonium pentaborate, and 8 ammonium pentaborate, etc. are mentioned. As the ester of boric acid, it is mentioned by ester with alkyl alcohol of the carbon numbers 1-6 as preferably as boric acid, and more specifically, Boric acid monomethyl, boric acid dimethyl, trimethyl borate, boric acid monoethyl, boric acid diethyl, boric acid triethyl, boric acid monopropyl, boric acid dipropyl, boric acid TORIPUROPIRU, boric acid monobutyl, boric acid dibutyl, tributyl borate, etc. are mentioned. (E) Although a boron content in an ingredient is arbitrary, In order to obtain a long fatigue life and good abrasion resistance, as for the content, it is preferred that it is more than 0.2 mass %, on the other hand, it is more than 0.4 mass %, and it is [as for the content, it is preferred that it is below 4 mass % and] 2.5 mass % more preferably.

[0061]Especially as a (E) ingredient of this invention, improvement in a fatigue life, and abrasion resistance from a point

of excelling in an effect of improving. Succinimid which has an alkyl group or an alkenyl group of the carbon numbers (E-1) 40-400 mentioned above in [at least one] a molecule, or its derivative is made into a nitrogen-containing compound, and things which denaturalized this with a boron compound, or these mixtures are used preferably.

[0062]In a lubricating oil composition of this invention, on a lubricating oil composition whole-quantity standard, content of the (E) ingredient is more than 0.001 mass % as an amount of boron elements, and there is more than 0.002 mass % preferably. On the other hand, on a lubricating oil composition whole-quantity standard, the content is below 0.05 mass % as an amount of boron elements, and is below 0.03 mass % preferably. (E) it is deficient in an effect of preventing pitching and a flaking by (E) ingredient combination when content of an ingredient is less than 0.001 mass %, and since the oxidation stability of a lubricating oil composition gets worse on the other hand when content of the (E) ingredient exceeds 0.05 mass %, it is not desirable respectively.

[0063]Publicly known lubricating oil additive can be added to a lubricating oil composition of this invention in order to improve performance as a lubricating oil further. Non-ash powder medicine which does not contain (F) Lynn system extreme pressure agent and (G) boron as an additive agent which can be added, for example, (H) A metal system cleaning agent, a (I) friction modifier, the (J) antioxidant, the (K) viscosity index improver, the (L) defoaming agent, the (M) rust preventives, (N) corrosion inhibitor, (O) pour point depressant, and (P) rubber swelling agents other than the (B) ingredient can be mentioned. these are independent -- it is -- several kinds can be combined and it can use.

[0064]Adding (F) Lynn system extreme pressure agent to a lubricating oil composition of this invention the abrasion resistance of a gear, and the friction characteristic of a wet clutch as a desirable Lynn system extreme pressure agent from a point kept good, For example, salts of alkyl dithiophosphate zinc, phosphoric acid, phosphorous acid, monoester phosphate, diester phosphate, trialkyl phosphate, phosphorous acid monoester, phosphorous acid diester, phosphorous acid triester, and phosphoric ester (**), these mixtures, etc. are mentioned.

[0065]Things except phosphoric acid and phosphorous acid are usually the carbon numbers 2-30 and a compound which contains a hydrocarbon group of 3-20 preferably among the above-mentioned Lynn system extreme pressure agents. As a hydrocarbon group of these carbon numbers 2-30, specifically, An ethyl group, a propyl group, a butyl group, a pentyl group, a hexyl group, a heptyl group, An octyl group, a nonyl group, a decyl group, an undecyl group, dodecyl, a tridecyl group, A tetradecyl group, a pentadecyl group, a hexadecyl group, a heptadecyl group, Alkyl groups, such as an octadecyl group (straight chain shape or a letter of branching may be sufficient as these alkyl groups); A butenyl group, A pentenyl group, a hexenyl group, a heptenyl group, an octenyl group, a nonenyl group, A decenyl group, an undecenyl group, a dodecenyl group, a tridecenyl group, a tetra decenyl group, Alkenyl groups, such as a penta decenyl group, a hexa decenyl group, a heptadecenyl group, and an octadecenyl group (straight chain shape or a letter of branching may be sufficient as these alkenyl groups, and) A position of a double bond is also arbitrary and A certain; cyclopentylic group, a cyclohexyl group, A cycloalkyl group of the carbon numbers 5-7 of a cycloheptyl group etc.; A methyl cyclopentylic group, A dimethyl cyclopentylic group, a methylethyl cyclopentylic group, a diethyl cyclopentylic group, a methylcyclohexyl group, a dimethyl cyclohexyl group, a methylethyl cyclohexyl group, a diethyl cyclohexyl group, a methyl cycloheptyl group, An alkyl cycloalkyl group of the carbon numbers 6-11 of a dimethyl cycloheptyl group, a methylethyl cycloheptyl group, a diethyl cycloheptyl group, etc. (replacement positions to a cycloalkyl group of an alkyl group are also arbitrary); A phenyl group, Aryl groups, such as a naphthyl group : A tolyl group, a xylyl group, an ethyl phenyl group, A propyl phenyl group, a buthylphenyl group, a pentyl phenyl group, a hexyl phenyl group, A heptyl phenyl group, an octyl phenyl group, a nonylphenyl group, a decyl phenyl group, Each alkyl aryl group of the carbon numbers 7-18, such as an undecyl phenyl group and a dodecyl phenyl group (straight chain shape or a letter of branching

may be sufficient as an alkyl group, and) Replacement positions to an aryl group are also arbitrary, and A certain; benzyl, a phenylethyl group, Each arylated alkyl group [of the carbon numbers 7-12, such as a phenylpropyl group, a phenylbutyl group, a phenylpentyl group, and a phenyl hexyl group,] (straight-chain-shape or letter of branching may be sufficient as these alkyl groups); etc. can be illustrated.

[0066](F) As a compound desirable as a Lynn system extreme pressure agent, Specifically Phosphoric acid; phosphorous acid; dipropyl dithiophosphate zinc, dibutyl dithiophosphate zinc, Dipentyl dithiophosphate zinc, dihexyl dithiophosphate zinc, diheptyl dithiophosphate zinc, Alkyl dithiophosphate zinc, such as dioctyl dithiophosphate zinc (straight chain shape or a letter of branching may be sufficient as an alkyl group); Monopropyl phosphate, Monobutyl phosphate, monopentyl phosphate, monohexyl phosphate, Phosphoric acid monoalkyl ester, such as MONOPEPU chill phosphate and mono- octyl phosphate (straight chain shape or a letter of branching may be sufficient as an alkyl group); Monophenyl phosphate, Phosphoric acid mono- (alkyl) aryl ester, such as mono- cresyl phosphate; Dipropyl phosphate, Dibutyl phosphate, dipentyl phosphate, dihexyl phosphate, Phosphoric acid dialkyl ester, such as JIPEPU chill phosphate and dioctyl phosphate (straight chain shape or a letter of branching may be sufficient as an alkyl group); Diphenyl phosphate, Alkyl phosphodiester, such as JIKUREJIRU phosphate; TORIPURO pill phosphate, tributyl phosphate, Tripentyl phosphate, trihexyl phosphate, TORIPEPU chill phosphate, Phosphoric acid trialkyl ester, such as trioctylphosphate (straight chain shape or a letter of branching may be sufficient as an alkyl group); Triphenyl phosphate, Phosphoric acid Tori (alkyl) aryl ester, such as tricresyl phosphate; Monopropyl phosphite, Monobutyl phosphite, monopentyl phosphite, monohexyl phosphite, Phosphorous acid monoalkyl ester, such as MONOPEPU chill phosphite and mono- octylphosphite (straight chain shape or a letter of branching may be sufficient as an alkyl group); Monophenyl phosphite, Phosphorous acid mono- (alkyl) aryl ester, such as mono- cresyl phosphite; Dipropyl phosphite, Dibutyl phosphite, dipentyl phosphite, dihexyl phosphite, Phosphorous acid dialkyl ester, such as JIPEPU chill phosphite and dioctyl phosphite (straight chain shape or a letter of branching may be sufficient as an alkyl group); Diphenyl phosphite, Phosphorous acid JI (alkyl) aryl ester, such as JIKUREJIRU phosphite; TORIPURO pill phosphite, tributyl phosphite, tripentyl phosphite, trihexyl phosphite, Trialkyl phosphite ester, such as TORIPEPU chill phosphite and trioctyl phosphite (straight chain shape or a letter of branching may be sufficient as an alkyl group); Triphenyl phosphite, Phosphorous acid Tori (alkyl) aryl ester [, such as tricresyl phosphite,];, these mixtures, etc. can be illustrated.

[0067]As a salt of the above-mentioned (**) phosphoric ester, Specifically Monoester phosphate, diester phosphate, phosphorous acid monoester, Nitrogen compounds, such as an amine compound which contains only ammonia, and a hydrocarbon group or a hydroxyl group content hydrocarbon group of the carbon numbers 1-8 in a molecule, are made to act on phosphorous acid diester etc., and a salt etc. which neutralized a part or all of acid water matter that remains can be illustrated. As this nitrogen compound, specifically Ammonia; monomethylamine, Monoethyl amine, monopropyl amine, monobutyl amine, monopentylamine, Monohexylamine, monoheptyl amine, mono- octylamine, dimethylamine, Methylethyl amine, diethylamine, methylpropyl amine, ethyl propylamine, Dipropyl amine, methylbutyl amine, an ethyl butylamine, a propyl butylamine, Dibutyl amine, dipentylamine, dihexyl amine, diheptylamine, Alkylamine, such as dioctyl amine (straight chain shape or a letter of branching may be sufficient as an alkyl group); Monomethanol amine, Monoethanolamine, mono- propanolamine, monobutanol amine, Monopentanol amine, monohexanol amine, monoheptanol amine, Monooctanol amine, mononononanol amine, dimethanol amine, Methanol ethanolamine, diethanolamine, methanol propanolamine, ethanol propanolamine, dipropanolamine, methanol butanol amine, ethanol butanol amine, propanol butanol amine, dibutanolamine, Alkanolamine [, such as dipentanol amine, dihexanol amine, diheptanol amine, and dioctanol amine,] (straight-chain-shape or letter of branching may be sufficient as alkanol group);,

these mixtures, etc. can be illustrated. These (F) Lynn system extreme pressure agents can blend arbitrarily one kind or two kinds or more. When making (F) Lynn system extreme pressure agent contain in a lubricating oil composition of this invention, the content in particular is not limited, but it is preferred that it is 0.005 - 0.2 mass % as a phosphorus element on a lubricating oil composition whole-quantity standard. Since oxidation stability gets worse when a case of less than 0.005 mass % is ineffective to abrasion resistance as a phosphorus element and it exceeds 0.2 mass %, it is not desirable respectively.

[0068]It is desirable to use together non-ash powder medicine which does not contain (G) boron in a lubricating oil composition of this invention from a point which makes good the wet friction characteristic, the friction characteristic of a wet clutch, oxidation degradation tightness lubricating oil in use, and insoluble matter dispersibility. As non-ash powder medicine which does not contain boron which can be used together, non-ash powder medicine before denaturalizing this compound with a boron compound is specifically mentioned in a boron containing ashless dispersing agent of the (E) ingredient. In this invention, one kind or two kinds or more of compounds arbitrarily selected out of them can be used together in an arbitrary quantity. In this invention, when using together non-ash powder medicine which does not contain boron, the content is usually 0.1 to 10 mass % on a lubricating oil composition whole-quantity standard.

[0069]Although it is usable in arbitrary compounds usually used as a metal system cleaning agent for lubricating oils as metal system cleaning agents other than (H) (B) ingredient which can be used together to a lubricating oil composition of this invention, For example, sulfonate of an alkaline metal or alkaline-earth metals, phenate, NAFUTENETO, etc. can be mentioned. They can be used these being able to be independent or combining them two or more kinds. Sodium and potassium are illustrated as an alkaline metal and calcium, magnesium, etc. are illustrated as alkaline-earth metals, respectively. As a concrete metal system cleaning agent, sulfonate of calcium or magnesium and phenate are used preferably. The total basicity and an addition of these metal system cleaning agents can be arbitrarily chosen according to performance of a lubricating oil demanded.

[0070]Although it is usable in arbitrary compounds usually used as a friction modifier for lubricating oils as a (I) friction modifier which can be used together to a lubricating oil composition of this invention, For example, an amine compound, fatty acid ester, fatty acid amide, fatty acid metal salt, etc. which have an alkyl group of the carbon numbers 6-30 or an alkenyl group especially a straight chained alkyl group of the carbon numbers 6-30, or a straight chain alkenyl group in [at least one] a molecule are mentioned. as an amine compound -- straight chain shape of the carbon numbers 6-30, or a letter of branching -- desirable -- aliphatic series monoamine of straight chain shape, straight chain shape, or a letter of branching -- an alkylene oxide addition of aliphatic polyamine of straight chain shape or these fatty amines, etc. can be illustrated preferably. as fatty acid ester -- straight chain shape of the carbon numbers 7-31, or a letter of branching -- ester of fatty acid of straight chain shape, and aliphatic series monohydric alcohol or aliphatic polyhydric alcohol, etc. can be illustrated preferably. as fatty acid amide -- straight chain shape of the carbon numbers 7-31, or a letter of branching -- amide of fatty acid of straight chain shape, and aliphatic series monoamine or aliphatic polyamine, etc. can be illustrated preferably. as fatty acid metal salt -- straight chain shape of the carbon numbers 7-31, or a letter of branching -- alkaline earth metal salt (magnesium salt, calcium salt, etc.), zinc salt, etc. of fatty acid of straight chain shape are mentioned preferably. although one kind or two kinds or more of compounds arbitrarily selected out of these friction modifiers can be made to contain in an arbitrary quantity in this invention -- usually -- the content -- a lubricating oil composition standard -- 0.01 to 5.0 mass % -- it is 0.03 to 3.0 mass % preferably.

[0071]It is usable if it is generally used to lubricating oils, such as a phenol system compound and an amine compound, as a (J) antioxidant which can be used together to a lubricating oil composition of this invention. Specifically

Alkylphenols, such as 2-6-di-tert-butyl-4-methyl phenol. Bisphenols, such as the methylene- 4 and 4-bisphenol (2, 6-di-tert-butyl-4-methyl phenol). Naphthylamines, such as phenyl-alpha-naphthylamine, and dialkyl diphenylamine. Dialkyl phosphorodithioate zinc, such as di-2-ethylhexyl dithiophosphate zinc. (3, 5-di-tert-butyl-4-hydroxyphenyl) Fatty acid (propionic acid etc.), univalent, or polyhydric alcohol, For example, ester with methanol, octadecanol, 1, 6 hexadiol, neopentyl glycol, thiodiethylene glycol, triethylene glycol, pentaerythritol, etc., etc. are mentioned. Although one kind or two kinds or more of compounds arbitrarily selected out of these antioxidants can be made to contain in an arbitrary quantity, the content is usually 0.01 to 5.0 mass % on a lubricating oil composition whole-quantity standard.

[0072]As a (K) viscosity index improver which can be used together to a lubricating oil composition of this invention, What is called non-distributed viscosity index improvers, such as a homopolymer of one sort or two sorts or more of monomers or a copolymer specifically chosen from various methacrylic acid ester, or its hydrogenation thing, Or what is called a distributed viscosity index improver etc. to which copolymerization of the various methacrylic acid ester which contains a nitrogen compound further was carried out can be illustrated. as the example of other viscosity index improvers -- non-distributed type or a distributed ethylene-alpha olefin copolymer (as alpha - olefin -- propylene.) 1-butene, 1-pentene, etc. can be illustrated or a copolymer of the hydride, polyisobutylene or its hydrogenation thing, and a styrenediene hydride, a styrene maleic-anhydride-ester copolymer, poly alkyl styrene, etc. can be mentioned.

[0073]A molecular weight of these viscosity index improvers needs to select in consideration of shear stability. Specifically a number average molecular weight of a viscosity index improver, For example, in the case of distributed type and non-distributed polymethacrylate, 5,000-150,000 -- a thing of 5,000-35,000 preferably, a case of polyisobutylene or its hydride -- 800-5,000 -- desirable -- a thing of 1,000-4,000 -- a case of an ethylene-alpha olefin copolymer or its hydride -- 800-150,000 -- a thing of 3,000-12,000 is preferably preferred. Especially when an ethylene-alpha olefin copolymer or its hydride is used also in these viscosity index improvers, a lubricating oil composition excellent in shear stability can be obtained. In this invention, although one kind or two kinds or more of compounds arbitrarily selected out of these viscosity index improvers can be made to contain in an arbitrary quantity, the content is usually 0.1 to 40 mass % on a lubricating oil composition standard.

[0074]Although it is usable in arbitrary compounds usually used as a defoaming agent for lubricating oils as a (L) defoaming agent which can be used together to a lubricating oil composition of this invention, silicone, such as dimethyl silicone and fluorosilicone, is mentioned, for example. Although one kind or two kinds or more of compounds arbitrarily selected out of these can be made to contain in an arbitrary quantity, the content is usually 0.001 to 0.05 mass % on a lubricating oil composition whole-quantity standard.

[0075](M) As a rust preventive, alkenyl succinic acid, alkenyl succinate, multivalent alcohol ester, petroleum sulfonate, dinonylnaphthalene sulfonate, etc. can be mentioned, for example.

(N) As corrosion inhibitor, a compound of a benzotriazol system, a tollyltriazole system, and an imidazole series, etc. can be mentioned, for example.

(O) Polymer etc. of a polymethacrylate system which suits lubricant base oil to be used as pour point depressant, for example can be mentioned.

(P) A compound of an aromatic system is mentioned as a rubber swelling agent. Although content of an additive agent of these (M) ingredients, the (N) ingredient, the (O) ingredient, and the (P) ingredient is arbitrary, content of an additive agent of 0.005 - 0.2 mass % and others of content of corrosion inhibitor is usually a 0.005 - 10 mass % grade on a constituent whole-quantity standard, respectively.

[0076]

[Example]Although an example and a comparative example explain this invention still more concretely below, this invention is not limited to these examples at all.

(Examples 1-8, comparative examples 1-8) As were shown in Table 1 and it was shown in the lubricating oil composition for gearboxes (examples 1-8) and Table 2 of this invention, the lubricating oil composition for comparison (comparative examples 1-8) was prepared, respectively. These lubricating oil compositions were evaluated by doing the life test of the following (1) shudder prevention performance, and (2) fatigue life examinations. Those evaluation results were written together to Table 1 and 2.

[0077](1) It is based on the "automatic transmission fluid shudder prevention performance testing method" specified to shudder life test JASO M349-98, The low-speed slip test which changed only the oil temperature under durability test into 140 ** from 120 ** was done, and the ratio with the life of the constituent of the life of a standard oil, an example, or a comparative example specified by the said examining method estimated the maintenance **** of shudder prevention performance. Performance measurement went every 24 hours 0, 6, 12, 24, and henceforth. When the life was more than the standard oil (not less than 72h), it was judged that the lubricating oil composition was excellent in the life of shudder prevention performance. And when 4 times (288h) of a standard oil were exceeded, the examination was closed, and it wrote or more as four.

[0078](2) The fatigue life was measured in the following way, using a 2 cylinder fatigue tester as a fatigue life examination testing machine.

(Cylinder)

Construction material :SCN436 shape : 68 mm x phi10-mm hardness : SB 3000-340 (test condition)

peripheral velocity :driving-side: -- 12 m/s and driving-side:10 m/s oil temperature : 60 ** planar pressure : Time until surface damages, such as pitching, occur in 12MPa (decision criterion) cylindrical surface was made into the fatigue life, and when the fatigue life was not less than 50h, it was judged as the constituent with a long fatigue life.

[0079]

[Table 1]

ID=000014

[Table 2]

ID=000015

[0080]In the passage clear from the result shown in Table 1, the life of shudder prevention performance is long, and, as for each lubricating oil composition of Examples 1-8 of this invention, the pitching-proof life also shows a long time. When the heavy base oil which shows high kinetic viscosity to base oil is mixed so that especially Examples 7 and 8 may

see, it turns out that a pitching-proof life becomes long further. On the other hand, by the case (comparative example 1) where there is too much content of (B) calcium salicylate, when (B) calcium salicylate is not included (comparative example 2), a pitching life is inferior [a shudder prevention life is inferior, and], so that clearly from the result shown in Table 2. When the value with which it was satisfied of any performance is not obtained when there is too much content of (C) SP system extreme pressure agent (comparative example 3), and (C) SP system extreme pressure agent is not included (comparative examples 4-6), a pitching life and a shudder prevention life are incompatible. (D) When succinimid is not included (comparative example 7), it is inferior to a shudder prevention life, and when the (E) boron containing ashless dispersing agent is not included (comparative example 8), it is inferior to a pitching life.

[0081]

[Effect of the Invention]The lubricating oil composition of this invention is excellent in a shudder prevention life, and has simultaneously the outstanding performance in which a fatigue life is long. Especially the lubricating oil composition of this invention as a gearbox oil Therefore, an automatic transmission and/or a nonstep variable speed gear. Or can use it conveniently as a lubricating oil composition for gearboxes which has a wet clutch and/or a wet oiling brake, and also. It can be used also as the lubricating oil in which improvement in the fatigue life by prevention of pitching etc. is demanded, for example, gear oil, internal combustion engine oil, the hydraulic oil for buffers, compressor oil, etc.

[Translation done.]